

Reference # 3

IL0335-06

REFERENCE

SITE NAME Alton Municipal landfill

SITE ID LD980497614

EPA Region 5 Records Ctr.



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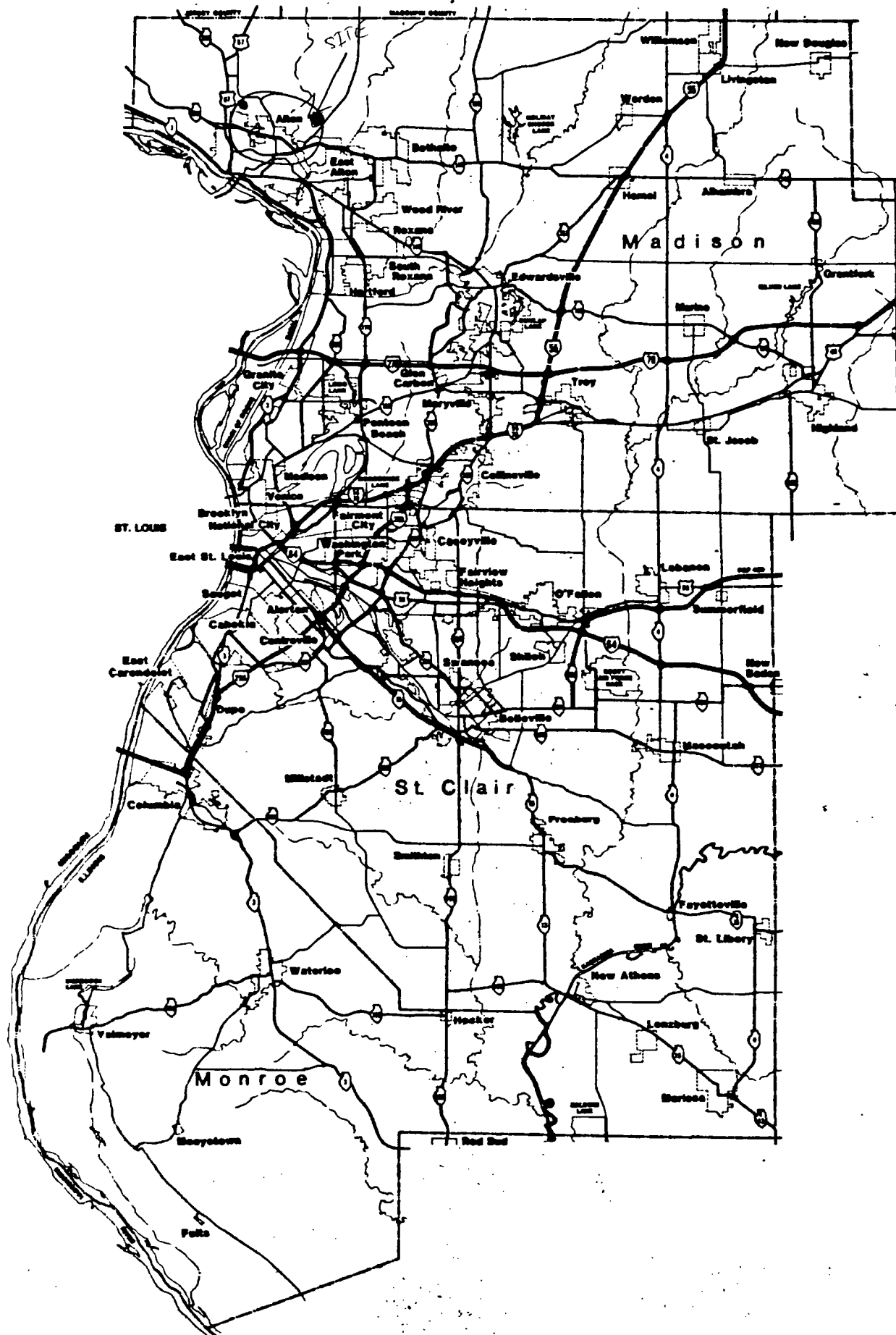
A SUMMARY OF INFORMATION
RELATED TO THE COMPREHENSIVE MANAGEMENT OF GROUNDWATER RESOURCES
IN MADISON, MONROE, AND ST. CLAIR COUNTIES, ILLINOIS

By

SOUTHWESTERN ILLINOIS METROPOLITAN
AND REGIONAL PLANNING COMMISSION

November, 1983

● = site



I. INTRODUCTION

Groundwater is a vitally important natural resource that, until recent years, has been taken for granted and given little protection. Natural underground reservoirs (aquifers) vary greatly in the quantity of water available for use. Where present and capable of supplying water they have many advantages over surface water sources. They are readily available for storing water without any expenditures for construction purposes. They have large capacities and don't become clogged with silt and weeds as do lakes. Relatively inexpensive to tap, underground reservoirs lose little or no water by evaporation, they can supply water over large areas without the necessity of building canals, pipelines, or distribution systems; and, if properly managed, their period of usefulness has no foreseeable limit for all practical purposes.

Dependability is another major benefit of groundwater as a source of supply. Droughts and dry spells that lower levels in streams and lakes seldom have any substantial impact on groundwater reservoirs. Even though natural recharge through the soil is reduced or even halted during such periods, large amounts of water are usually present in the groundwater bank, where they serve as a reserve to tide the well owner over until the rains come again. In addition, because groundwater is insulated and protected below the surface of the earth, it is usually far less subject to contamination and pollution than the water in rivers and lakes.

Despite the fact that most groundwater aquifers have a natural protective barrier, instances of contamination of groundwater used for public and private drinking water supplies have been reported throughout the country. The critical aspect of groundwater pollution is that, once contaminated it may be decades before it can be used due to its very slow movement and limited mixing. Unlike surface water, groundwater quality cannot be "corrected" by applying pollution control measures after the pollution has occurred. Cleanup is difficult and costly -- sometimes impossible. In addition, monitoring groundwater quality is a difficult task. Not only because wells must be dug, but because the lack of mixing in an aquifer dictates that several samples from different locations and levels are needed to get an accurate picture of groundwater quality in an area.

Uses of Groundwater in Madison, St. Clair and Monroe Counties

Groundwater has become valuable as a water source throughout the three-county area, serving as a supply for public, industrial, domestic and agricultural uses. The area's major aquifers are located in the American Bottoms (also known as the Mississippi River flood plain), the lowland area which lies between the Mississippi River and the bluffs along the western edge of the study region. In addition to being the area's largest

groundwater source, it is also the location of major concentrations of urbanization and industrialization.

Within the three counties, thirty-three (33) separate public water supply systems obtain water from ground sources. Twenty (20) of these systems are for municipalities (see Table 1) while the remaining thirteen (13) systems supply areas such as mobile home parks, schools, and industry. These twenty systems use approximately 10.3 million gallons per day (mgd) to supply an estimated 120,919 persons. The largest withdrawals are made in the American Bottoms area to serve the larger population in that area with the smaller withdrawals being made for the communities in the eastern section of the upland.

Industry is a major user of groundwater in the American Bottoms (see Chapter III). Although industrial pumpage has decreased in recent years it still serves as a valuable resource. A major advantage of groundwater is that it maintains an almost constant temperature throughout the year. Industries, as a result, are able to utilize the groundwater for cooling water during the summer months when the Mississippi River water is warm. In addition, the cost of treating the groundwater is lower than treating Mississippi River water which is heavily laden with sediment and chemicals.

Groundwater is also used for domestic and irrigation purposes but in relatively small amounts. For most rural areas, however, groundwater represents the only economical source of water. Rural water users are greatly dispersed. It would be economically prohibitive to design and develop a water system which could supply relatively few users over an extensive area. Therefore, rural residents are often totally dependent upon groundwater. Groundwater for irrigation accounts for a very small portion of total groundwater usage, approximately one percent. Most of the irrigation wells are located in the American Bottoms and are used primarily to irrigate horseradish and truck crops. The amount of groundwater pumped depends in large part on climatic conditions. In years with significantly below normal precipitation there is a substantial increase in the amount of groundwater pumpage.

The potential for polluting groundwater is high in many portions of the study area. This is particularly true within the American Bottoms and major flood plains throughout the region. Within these lowland areas, groundwater levels are generally high and therefore more susceptible to pollution from solid and liquid waste disposal. Major sources of potential groundwater pollution within the three-county area are identified in the following chapters.

Purpose and Scope

The purpose of this report is to summarize and interpret available information related to groundwater occurrence, movement, availability, use,

Table 1

LOCATION OF GROUNDWATER SOURCES FOR COMMUNITIES
OF MADISON, ST. CLAIR AND MONROE COUNTIES

Community	Estimated Population Served	Average Daily Withdrawals (MGD)	Location of Groundwater Source	
			American Bottoms	Other Than the American Bottoms
MADISON COUNTY:				
Alhambra	825	0.060		X
Bethalto	18,239	1.380		X
Collinsville	23,698	2.150	X	
East Alton	7,500	0.650	X	
Edwardsville	26,993	1.790	X	
Glen Carbon	5,310	0.530	X	
Hamel	600	0.059		X
Hartford	1,680	0.360	X	
Holiday (MHP)	600	0.027	X	
Livingston	967	0.057		X
Marine	1,004	0.074		X
Maryville	3,393	0.299	X	
Roxana	3,886	0.580	X	
St. Jacob	862	0.057		X
Troy	9,245	0.681	X	
Wood River	1,500	1.000	X	
Worden	950	0.060		X
Subtotal	119,552	10.141		
ST. CLAIR COUNTY:				
Fayetteville	380	0.024		X
Mounds (PWD)	2,200	0.108	X	
St. Libory	550	0.057		X
Subtotal	3,130	0.189		
MONROE COUNTY:				
Valmeyer	900	0.075		X
Maeystown	137	0.011		X
Maple Leaf Estates	42	0.005		X
Timber Lake Estates	75	0.005		X
Subtotal	1,154	0.096		
TOTAL	123,836	10.426		

Source: IEPA, Division of Public Water Supplies,
Collinsville Field Office, 1983.

II. AREA DESCRIPTION

The study area, as illustrated on Figure 1, consists of the Southwestern Illinois Counties of Madison, St. Clair and Monroe. These three counties, which encompass approximately 1,800 square miles, are included in the Illinois portion of the St. Louis Standard Metropolitan Statistical Area (SMSA) and constitute the second largest urban area within the State of Illinois.

Physical Characteristics

Topography - There are four major topographic features within the three-county study area: (1) ~~the American Bottoms~~; (2) the Kaskaskia River Valley; (3) the terrace and outwash area of the Kaskaskia River; and (4) the upland areas which have a number of distinct landforms.

X The Mississippi River Valley consists of three distinct landforms: (1) flat to depressional areas - broad swales, sloughs, and old lakes which are high in clay content; (2) ridge and swale areas characterized by alternative ridges and swales; and (3) terraces located primarily on the foot slopes of the bluff region.

The alluvial valley is protected from overbank flooding of the Mississippi River by an intensive levee system. However, considerable ponding and/or flooding still occurs particularly within the flat to depressional areas, swales and sloughs.

The Mississippi River Valley is highly urbanized from Alton to Dupu. Many roads and railroads traverse the area. These urban activities have altered the naturally poor drainage systems, adding to the surface drainage problem.

The Kaskaskia River Valley is a nearly level alluvial area largely composed of silty sediments. Although the river is the principal watercourse draining the upland areas, the mainstem traverses only the southeastern portion of St. Clair County and eastern part of Monroe County. Due to the frequency of flooding there is little development in the river valley. The bottomlands are either wooded or in agriculture.

The Terrace and Outwash Area of the Kaskaskia River has low relief and appears as a plain with poorly defined drainage and subtle relief. The terrace area, which lies just above the alluvial valley, is composed of silty material overlain by clay. This nearly flat, very slowly permeable area is relatively poor in terms of crop production.

area is comprised of residential uses and 19 percent industrial concerns and commercial establishments. Heavy industry (steel mills, oil refineries, meat packing, chemical industries and metal fabricating) is located on the western edge of St. Clair and Madison Counties in the American Bottoms. Light industries are scattered throughout the counties with the largest concentrations located in the Cities of Belleville and Highland. Commercial development is scattered throughout the area with regional shopping centers at Fairview Heights and Alton.

~~The remaining 1,646 square miles or 92 percent of the total study area includes farmland (900 square miles or 51 percent is in crops), residential and miscellaneous uses.~~

Based on the 1980 population trends, urbanization is expected to continue along the upland corridor from Belleville to Edwardsville.

Hydrometeorologic Conditions

The Southwestern Illinois region experiences a continental climate characterized by hot, humid summers and mild winters punctuated by extremely cold periods of short duration. The three-county study area of Madison, St. Clair and Monroe Counties is situated in a major frontal zone resulting from the convergence of warm moist air from the Gulf of Mexico and cold, dry air from Canada. This frontal zone produces a variety of weather conditions which are subject to rapid changes.

Precipitation - The 80-year average precipitation for the region is 35.4 inches per year. In the last 25 years the average has been 39.5 inches. June is normally the wettest month and has an average of 4.3 inches of rain. Thunderstorms produce much of the summer rainfall and also are responsible for the unusually heavy rains which may result in isolated flooding. Long-term records show monthly precipitation maximums of 10 and 11 inches to be rather rare during the summer months. A few daily precipitation maximums of 3 and 4 inches occur during the most severe summer thunderstorms. Rainstorms that produce 1 to 2 inches of precipitation in a few hours are rather common.

During the summer months, the mid-day relative humidity ranges between 50 and 60 percent with early morning readings near saturation. Heavy dews are common on clear calm nights.

Winter humidity is 10 to 15 percent higher when maritime tropical air from the Gulf moves in at temperatures just below freezing. Snow may occur in any or all months from early November through April. Average annual snowfall is approximately 17 inches. Most snowstorms produce less than 5 inches of snow but maximum depths of 10 to 12 inches do occur in the most

severe storms. Although winter ice storms are not a yearly occurrence, most records suggest that damaging ice storms severe enough to harm trees and power lines can be expected about three times in ten years.

Temperature - The region experiences an average annual temperature of 56 degrees Fahrenheit. Temperatures range from a January mean of 32 degrees F. to a rather warm mean temperature of 79 degrees F. in July. Winter months are generally cloudy, damp and chilly. Severe outbreaks of cold polar air move through the region each winter and produce minimum temperatures as low as -10 to -15 degrees F.

The months of July and August are hot and very often humid. Maximum temperatures above 90 degrees F. are recorded on an average of 22 days. When warm high pressure centers stagnate over this region, temperatures will exceed 100 degrees F. for short periods of 3 to 5 days.

Major Drainage System

Although it drains ultimately to the Mississippi River, the three-county study area is divided naturally into two major watersheds or river basins -- the Mississippi and the Kaskaskia. (See transparent overlay.)

~~The Mississippi extends the entire length of the study area draining the American Bottoms and its tributary upland area. Major upland tributaries include the Wood River, Cahokia Creek and Carr Creek.~~ In the American Bottoms, drainage has been altered by artificial (man-made) drainage canals (the Cahokia Diversion Channel, Cahokia Canal, Harding Ditch, Canal No. One and the Prairie du Pont Floodway) which intercept flow from many small streams which drain the eastern upland bluff area. These leveed canals traverse the valley bottom in a west to southwesterly direction to the Mississippi River.

The Kaskaskia River and its tributaries drain the remainder of the eastern upland area. The mainstem of the river enters the study area at approximately mid-point in eastern St. Clair County. Drainage for the northeastern portion of the area is provided by a major tributary stream, Silver Creek, which flows southward to its confluence with the Kaskaskia River at New Athens. Richland Creek drains portions of St. Clair County including the Belleville area. Both Richland and Horse Creeks provide drainage in eastern Monroe County.

III. GROUNDWATER QUANTITY

Geohydrology

~~The bedrock underlying the study area consists of Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, Permian, and Triassic sandstone, dolomite, and limestone. The bedrock is composed of granite. Tilting and folding of the bedrock surface resulted in the present bedrock surface topography shown in Figure 2 and the distribution of the uppermost bedrock units as shown in Figure 3.~~

The Ordovician rocks, which consist mainly of limestone and dolomite with minor quantities of sandstone, are found only beneath a small portion of the American Bottoms in Monroe County. The Ordovician system dips sharply eastward toward a geologic depression known as the Illinois Basin and is thus found at much greater depths throughout the remainder of the three counties. The Ordovician limestone and dolomite formations are potential sources of groundwater but have not been exploited due to the excellent possibilities in the shallow sand and gravel aquifers.

The Silurian and Devonian bedrock lies under younger bedrock formations throughout the study area. Consisting of limestone and dolomite, the rocks may yield groundwater from joints and channels but the water is too deep and highly mineralized to be considered as potential sources of groundwater supply.

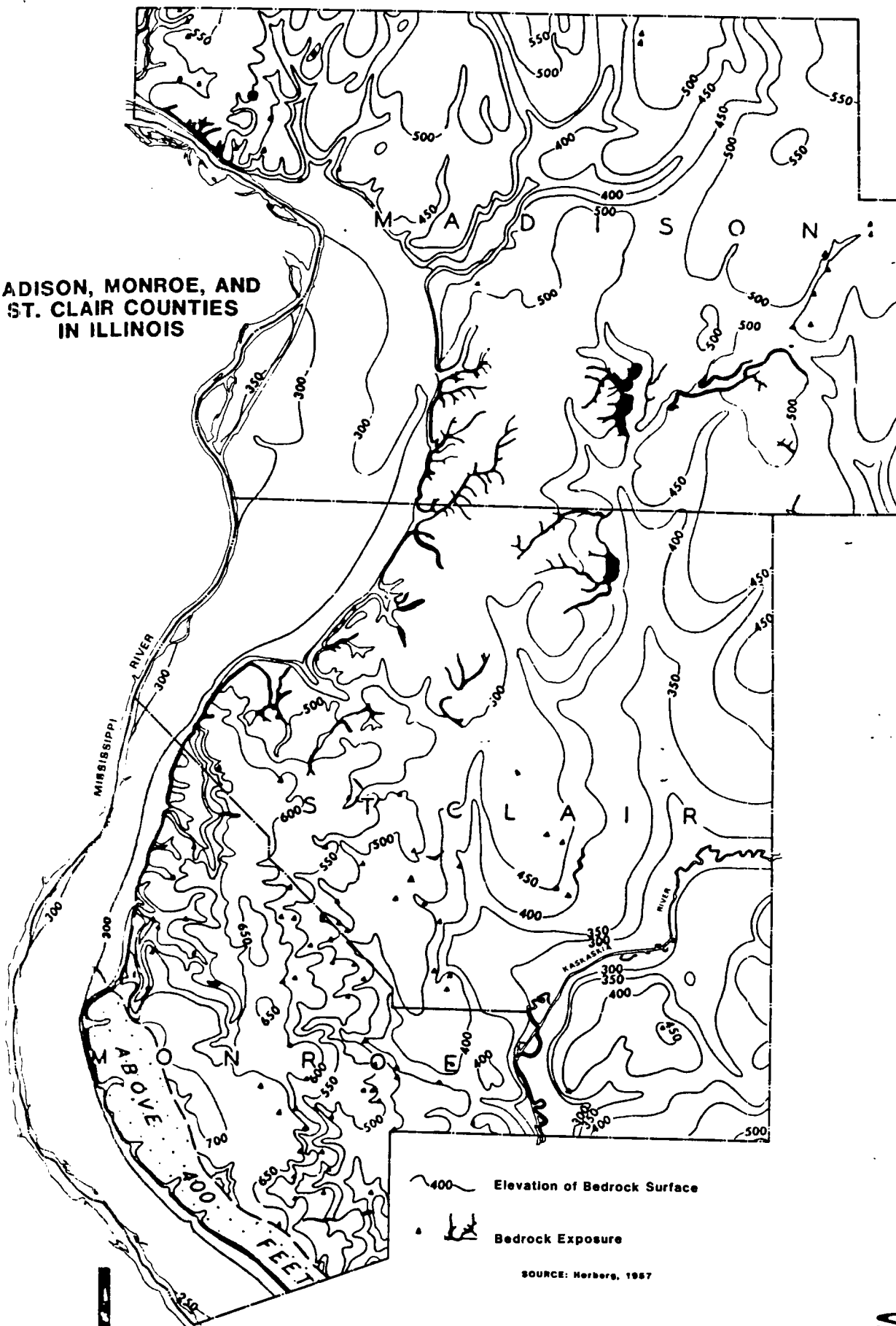
X ~~Mississippian rocks, consisting of limestone, sandstone, and shale, are prevalent throughout most of the western portion of the study area. Mississippian limestone sandstone and shale are potential sources of groundwater supply, but the water is too deep and highly mineralized to be considered as potential sources of groundwater supply. The unconsolidated sand and gravel aquifers are covered by this Mississippian formation. This bedrock aquifer is of little significance. The bottom of the shallow sand and gravel aquifer is of little significance.~~

Mississippian rocks in the extreme western uplands are fine-grained and cherty limestones in which abundant sinkholes occur forming Karst topography. Karst is a term used to describe a condition in which soluble limestone or dolomite has been partially dissolved as a result of chemical actions induced by water passing through carbonate rock. When sizeable quantities of rock have been dissolved, the land surface often subsides as a result of the lack of supporting bedrock. The surface depressions created are known as sinkholes and usually lead directly to caverns containing underground streams. Because of the damage of pollution in wells that penetrate shallow cavernous limestone, wells in this formation must be constructed with special attention to sanitary practices.

~~The Permian and Triassic rocks, consisting of sandstone, shale, and limestone, are found below the glacial drift in the central and eastern portions of the study area. These rocks are of little significance.~~

Bedrock Topography

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



SOURCE: Herberg, 1987

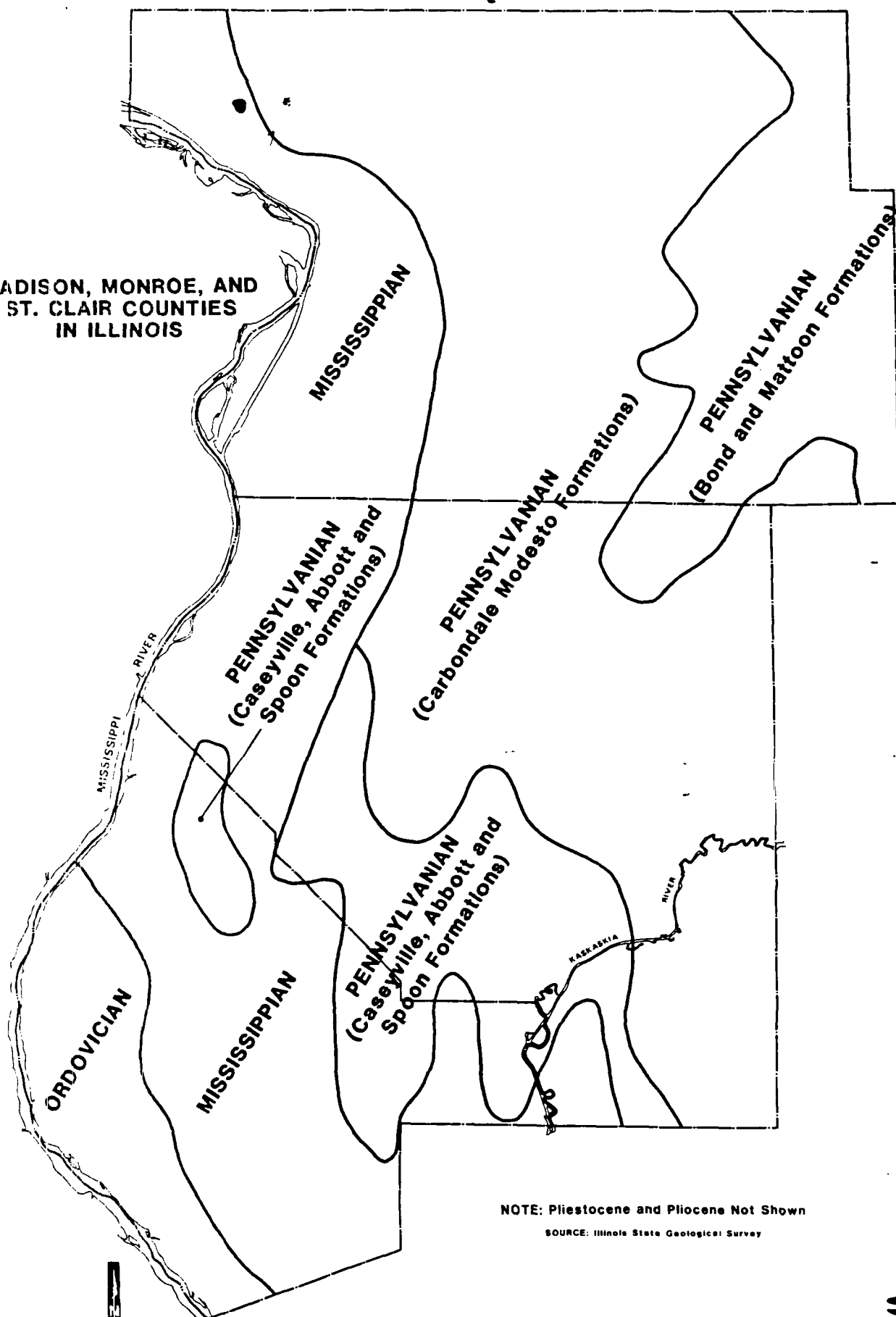
0 1 2 3 4 5 6 7 SCALE MILES
0 2 4 6 8 10 12 SCALE KILOMETERS

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SEB

Generalized Bedrock Geology

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



NOTE: Pleistocene and Pliocene Not Shown

SOURCE: Illinois State Geological Survey

1 2 3 4 5 6 7 SCALE MILES
1 2 3 4 5 6 7 8 9 10 11 12 SCALE KILOMETERS

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SRB

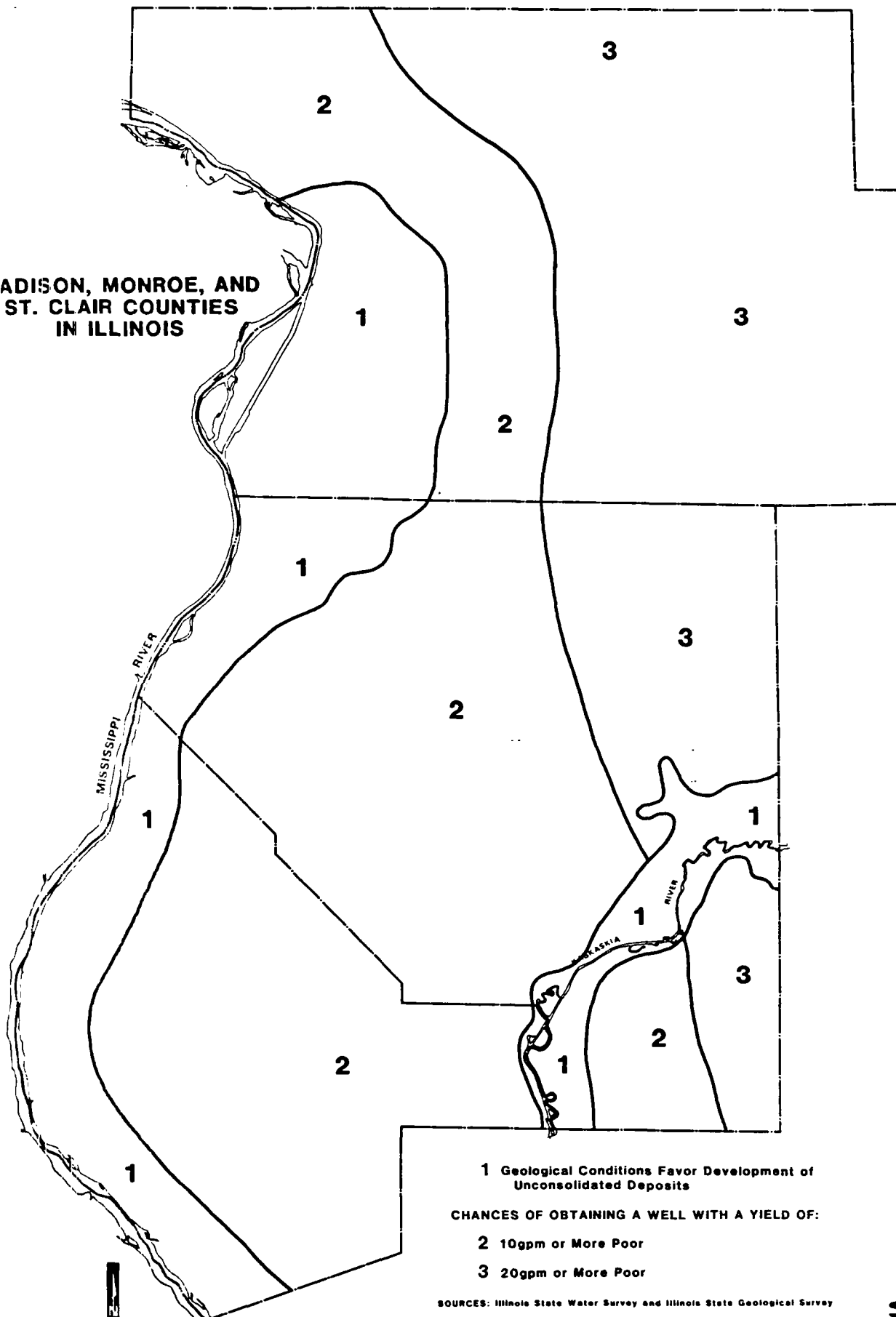
permeability and ~~generally~~ of shale, sandstone, limestone and ~~other~~. The water-yielding character of these formations is variable but generally low. The only formations that yield any appreciable amounts of water in these rocks are the sandstones. Because the sandstones differ laterally in permeability, they are not water-yielding at all sites. The chances of obtaining a well in the Pennsylvanian aquifers yielding more than 20 gpm are poor (see Figure 4). ~~In addition, the~~ ~~uniformity~~ ~~of the water's mineral content also~~ ~~is~~ ~~extremely~~ ~~limited~~. Locally, however, shallow sandstone and creviced limestone may yield small supplies of groundwater in areas where drift supplies are inadequate.

Unconsolidated Deposits - ~~The glacial drift, ranging in thickness from 200 feet, which blankets the bedrock in Southwestern Illinois, was deposited during the Pleistocene epoch. This later period in geologic history, which is often referred to as the~~ ~~began about one million years ago and was marked by the advance of continental glaciation. Although four major glacial advances are known in Illinois, glacial materials in the study area represent deposits left by only the last two advances -- the Illinoian and the Wisconsinan. The Illinoian Till Plain, comprising much of the area east of the Mississippi River, bluffs Wisconsinan till is not present within the study area due to the fact that the Wisconsinan is~~ ~~represented by a thin layer of drift. However, the effects of Wisconsinan glaciation within the study area are extremely widespread in the form of wind and water transported glacial materials. Reclaiming glacial deposits of sand, gravel, silt, and clay. After the flooding glacial meltwaters had receded, the glacial materials which had been deposited in the stream valleys became exposed. When these materials had dried, the wind picked up many of the fine-grained sand, silt and clay (mostly silt) and deposited them on the uplands in uniform layers known as loess. Since winds were generally from the northwest, the loess deposits are thicker on the uplands adjacent to the Mississippi River flood plain.~~ The distribution of the surficial materials is shown in Figure 5. The thickness of the glacial drift, which is identified in Figure 6, is highly variable. One hundred plus-foot thicknesses occur in the buried bedrock valley beneath the Kaskaskia River in eastern Monroe and St. Clair Counties as well as the Mississippi River. This drift and exposed bedrock are common in the upland area.

A majority of the available groundwater found in the study area is taken from valley fill materials. Most of the groundwater from valley fill material is withdrawn from the flood plain of the Mississippi and Kaskaskia Rivers. The probabilities for obtaining high yield wells for industrial and municipal uses are favorable in these areas (see Figure 7). High capacity wells reach excellent water yielding sand and gravel deposits at depths of 50 to 75 feet.

Estimated Potential Yields of Wells in Bedrock Aquifers

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



1 Geological Conditions Favor Development of
Unconsolidated Deposits

CHANCES OF OBTAINING A WELL WITH A YIELD OF:

2 10gpm or More Poor

3 20gpm or More Poor

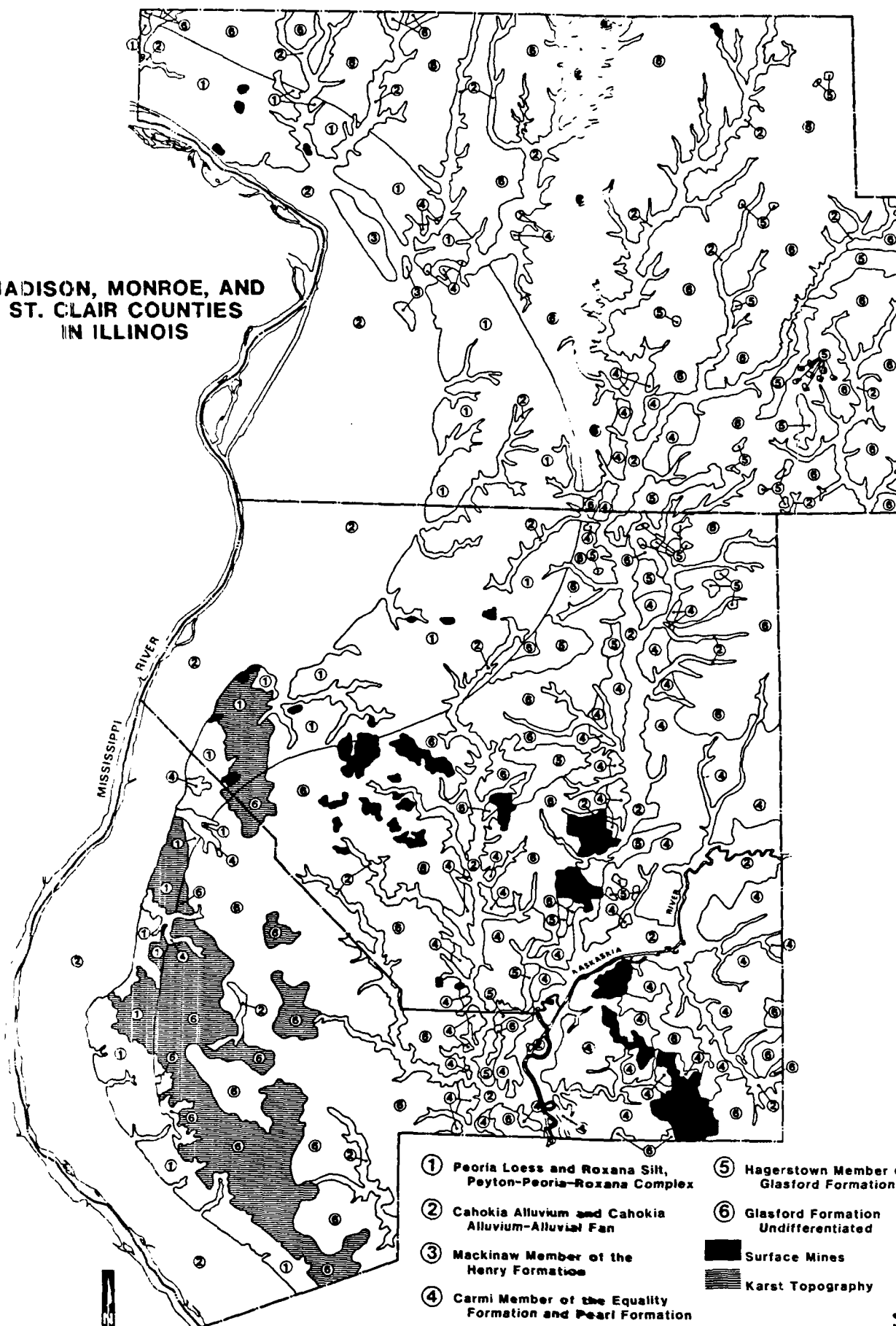
SOURCES: Illinois State Water Survey and Illinois State Geological Survey

SR

SCALE MILES
SCALE KILOMETERS

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Generalized Distribution of Quaternary Deposits

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS

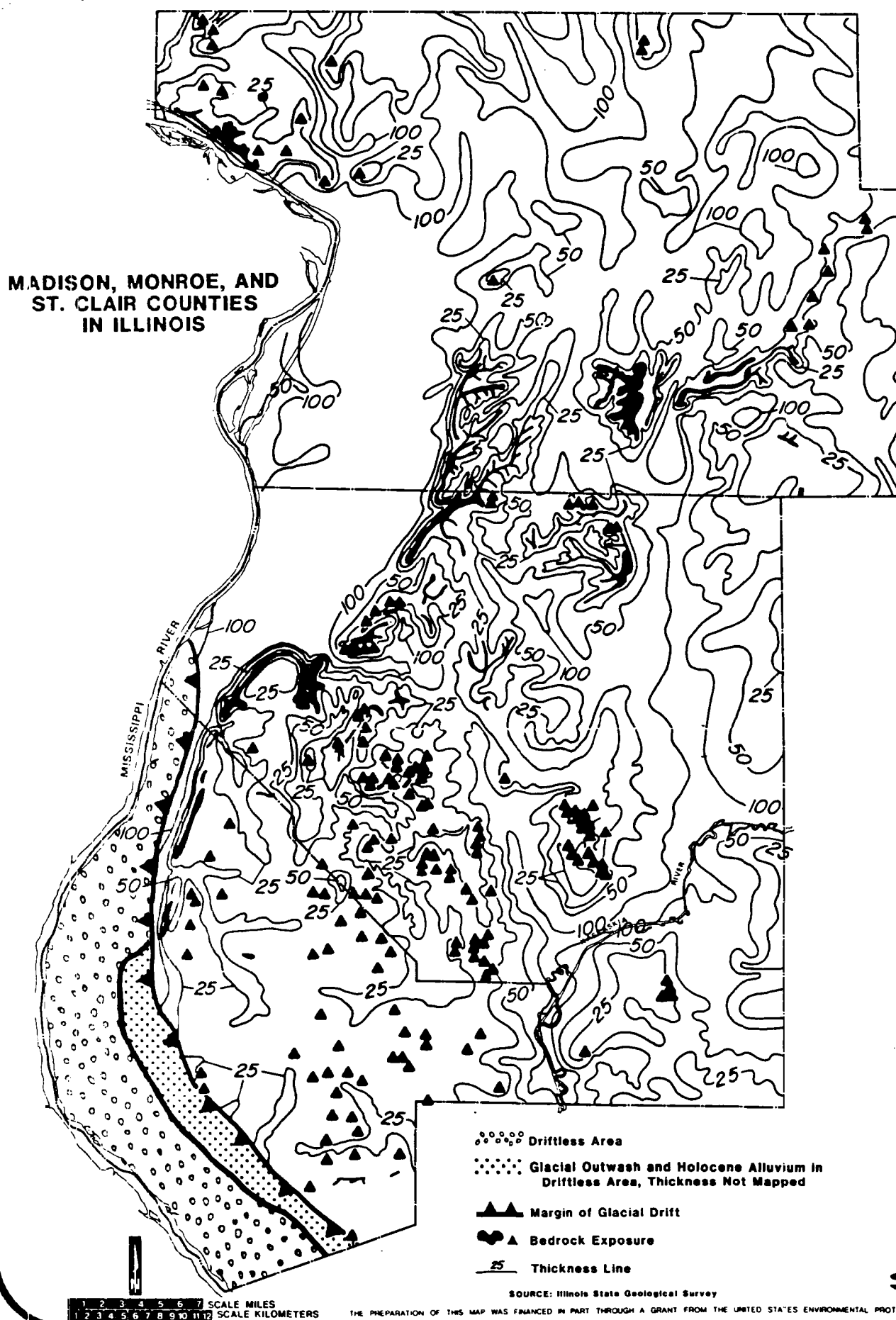
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1 2 3 4 5 6 7 8 9 10 11 12 SCALE KILOMETERS

SOURCE Illinois State Geological Survey

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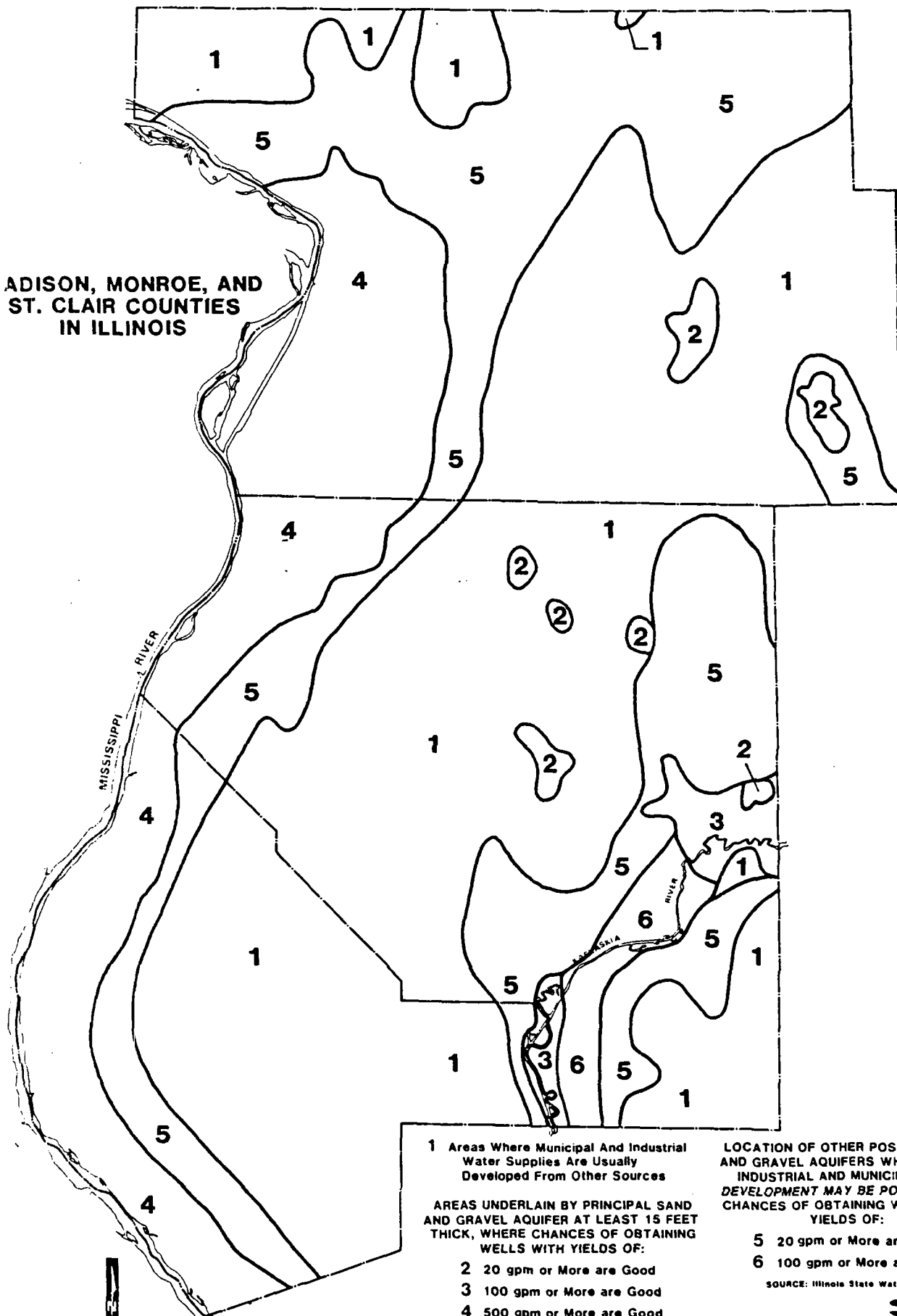
SR

Thickness of the Glacial Drift



Estimated Yields of Wells in Sand and Gravel Aquifers

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



The Mississippi River flood plain is the dominant source of groundwater recovered from valley fill materials. The valley fill is composed of recent alluvium and glacial valley train material and is underlain by Mississippian and Pennsylvanian bedrock, consisting of limestone and dolomite with subordinate amounts of sandstone and shale. It has an average thickness of 120 feet and ranges in thickness from less than one foot near the bluffs to over 170 feet near the City of Wood River. The valley fill is generally at its greatest thickness at a mid-point between the bluffs and the river. The coarsest deposits most favorable for water development are commonly encountered near bedrock and often average 30 to 40 feet in thickness. Recharge within the area is from precipitation, induced infiltration of surface water from the Mississippi River and small streams traversing the area, and subsurface flow from the bluffs bordering the area.

Groundwater Flow - The direction of groundwater flow is ideally determined from the collection and interpretation of regional water data. This data exists only for the sand and gravel aquifers in the American Bottoms. Only very limited data is available on other aquifers within the study area. The Illinois State Water Survey currently operates a network of 15 groundwater level observation wells in the study area, all of which are in the East St. Louis area. Figure 8 shows their location and Table 2 summarizes the types and periods of record for the water-level data.

drift deposits ~~and some movement~~ towards ~~into the deeper unconsolidated aquifers. Groundwater moves deeper in the deposits generally following the bedrock topography.~~ As a result, groundwater generally moves "downstream" through the sand and gravel aquifers in much the same direction as the original streamflow, but at a much slower rate.

Groundwater in the East St. Louis area generally moves slowly towards the west southwest to the Mississippi River and other streams and towards cones of depression created by industries and municipalities. The establishment of industrial centers and the subsequent use of large quantities of groundwater by industries and municipalities has lowered water levels appreciably in the areas of heavy pumping. Historically, the lowering of water levels in the major pumping centers along the Mississippi River has established hydraulic gradients from the Mississippi toward the pumping centers. At times groundwater levels are below the surface of the river at places, diverting appreciable quantities of water from the river into the aquifer by inducing infiltration.

Groundwater Levels - High groundwater levels are a major problem associated with the unconsolidated aquifer located in the Mississippi River flood plain, in particular the East St. Louis area. Contributing to the problem is the fact that groundwater levels in this area have steadily risen since

1957, due in part to the decrease in industrial use of groundwater. Additionally, there has been a significant and sustained rise in groundwater levels since the Mississippi River floods of 1973. The result has been widespread sewer damage, higher concentrations of minerals and chlorides in the groundwater and a greater potential for infiltration of pollutants into the groundwater, in particular pollutants from solid and liquid waste disposal.

Currently a network of approximately 250 private, industrial, and municipal wells is utilized every five years by the ISWS to measure water levels in the American Bottoms. A piezometric map is prepared from the data, and the relationship of water levels to pumpage is observed. In addition to five-year observations, the Survey maintains a network of 15 wells which are monitored monthly. Five of these wells are equipped with automatic level recorders (see Figure 8 and Table 2).

Presently, the U.S. Army Corps of Engineers, St. Louis District, is investigating groundwater flooding and associated problems in the American Bottoms. One alternative being considered by the Corps is controlled dewatering. Other agencies participating in this project are: the Illinois State Water Survey which is developing a model to predict fluctuations in groundwater levels based on the amount of rainfall and/or Mississippi River levels; and the U.S. Geological Survey which conducted a sampling program to provide information on existing groundwater quality.

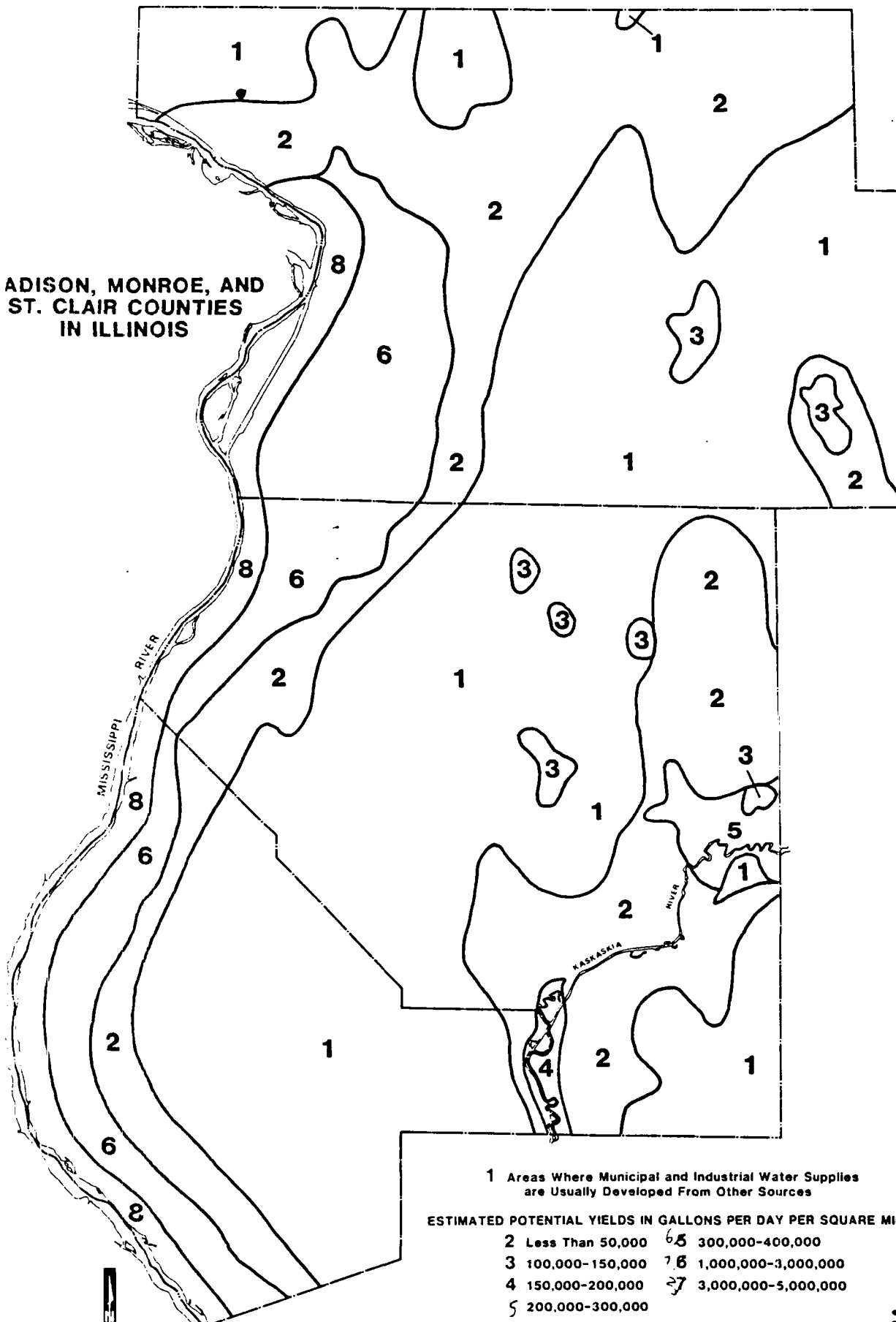
Potential Yields of Aquifers

~~_____ the greatest potential yield is found in the sand and gravel aquifers in the glacial till plain is sparse. Figure 9 illustrates the potential yields for these sand and gravel aquifers.~~
American and Kaskaskia Rivers. Potential yields of sand and gravel aquifers in the glacial till plain is sparse. Figure 9 illustrates the potential yields for these sand and gravel aquifers.

A very narrow strip of Mississippi River flood plain near the river is particularly suitable for the development of high-capacity wells. With conditions favorable for groundwater recharge from the river, this narrow strip has an estimated potential yield of 3,000,000 - 5,000,000 gallons per day per square mile (gpd/sq.mi.). With the exception of a narrow band at the foot of the bluffs, excellent groundwater yielding sand and gravel aquifers are also present throughout the remainder of the Mississippi River flood plain. Potential yields from this aquifer range from 300,000 gpd/sq.mi. to 400,000 gpd/sq.mi. That part of the flood plain near the base of the bluffs is less favorable for the development of high-capacity wells than the remainder of the flood plain. The sand and gravel deposits near the bluff are thinner than those closer to the river and are somewhat discontinuous. Wells in this area will yield less than 50,000 gpd/sq.mi. (see Figure 9).

Estimated Potential Yield of Principal Sand and Gravel Aquifers

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



1 Areas Where Municipal and Industrial Water Supplies
are Usually Developed From Other Sources

ESTIMATED POTENTIAL YIELDS IN GALLONS PER DAY PER SQUARE MILE

- 2 Less Than 50,000
- 3 100,000-150,000
- 4 150,000-200,000
- 5 200,000-300,000
- 6 300,000-400,000
- 7 400,000-500,000
- 8 500,000-1,000,000

SOURCE: Illinois State Water Survey

SEB

1 2 3 4 5 6 7 SCALE MILES
1 2 3 4 5 6 7 8 9 10 SCALE KILOMETERS

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The Kaskaskia River flood plain in eastern St. Clair County has the second largest yield potential in the three counties. The sand and gravel aquifer associated with this flood plain may yield 200,000 - 300,000 gpd/sq.mi. Smaller areas of somewhat lesser yields (150,000 - 200,000) are located further downstream in southern St. Clair County and eastern Monroe County. Little information is available about the thickness, texture, and continuity of the aquifers in the Kaskaskia flood plain. Only two municipalities -- Fayetteville and St. Libory -- obtain their water supplies from wells tapping sand and gravel deposits in Kaskaskia Bottoms.

Small areas with potential yields of 100,000 - 150,000 gpd/sq.mi. are associated with valley-fill deposits in eastern St. Clair and Madison Counties. The best yields are obtained from wells associated with Silver Creek. Only one community -- Alhambra in Madison County -- receives its water supply from wells tapping sand and gravel aquifers along the Silver Creek Bottoms. Prior to its participation in a public water supply district which obtains its water from the Kaskaskia River, the City of Lebanon also had a well in the creek bottoms.

The vast majority of the upland area the glacial till is thin and does not contain sand and gravel deposits which have the capability for yielding significant amounts of water. Aquifers with potential yields of less than 50,000 gpd/sq.mi. are available in the thin glacial deposits of northern Madison County, eastern and southern St. Clair County and in extreme eastern Monroe County. Water in the uplands is obtained by the Illinois State Water Survey as well as many municipal and industrial water supplies usually obtained from other sources in the Mississippi River Valley and the Kaskaskia River.

much lesser extent, in the Kaskaskia River alluvial valley, although

and [REDACTED] The Mississippian rocks (limestone, sandstone, and shale) which underlie the American Bottoms extend into the upland in almost all of Monroe County and to extreme northwestern Madison County. These bedrock aquifers have an estimated potential yield of 50,000 - 100,000 gpd/sq.mi. Karst topography present in these areas dictates that special precautions be taken when constructing wells to avoid polluting the aquifer. The remainder of the upland area is capable of producing less than 50,000 gpd/sq.mi. In many areas of the upland, however, the bedrock is the only groundwater source. Where the drift is thin and underlain by Pennsylvanian rocks limited amounts of groundwater for domestic and farm use can be obtained from shallow sandstones and creviced limestones. As the depth of the aquifer increases the mineral content also increases thereby limiting its use.

Potential availability of additional surface water supplies for Madison, St. Clair, and Monroe Counties is discussed in a 1966 report by the Illinois State Water Survey, Potential Surface Water Reservoirs of South-Central Illinois. This report identified 26 potential reservoir sites in the three-county area, one of which was subsequently constructed -- Holiday Shores Lake on Joulters Creek. The remaining 25 potential reservoirs have a combined net yield of approximately 60.4 mgd when full, based on a 25-year drought recurrence interval. Madison County has 10 potential reservoir sites; St. Clair County, 9; and Monroe County, 6. Approximately 66 percent (40.6 mgd) of this net yield is derived from the 9 potential reservoir sites shown in Figure 10.

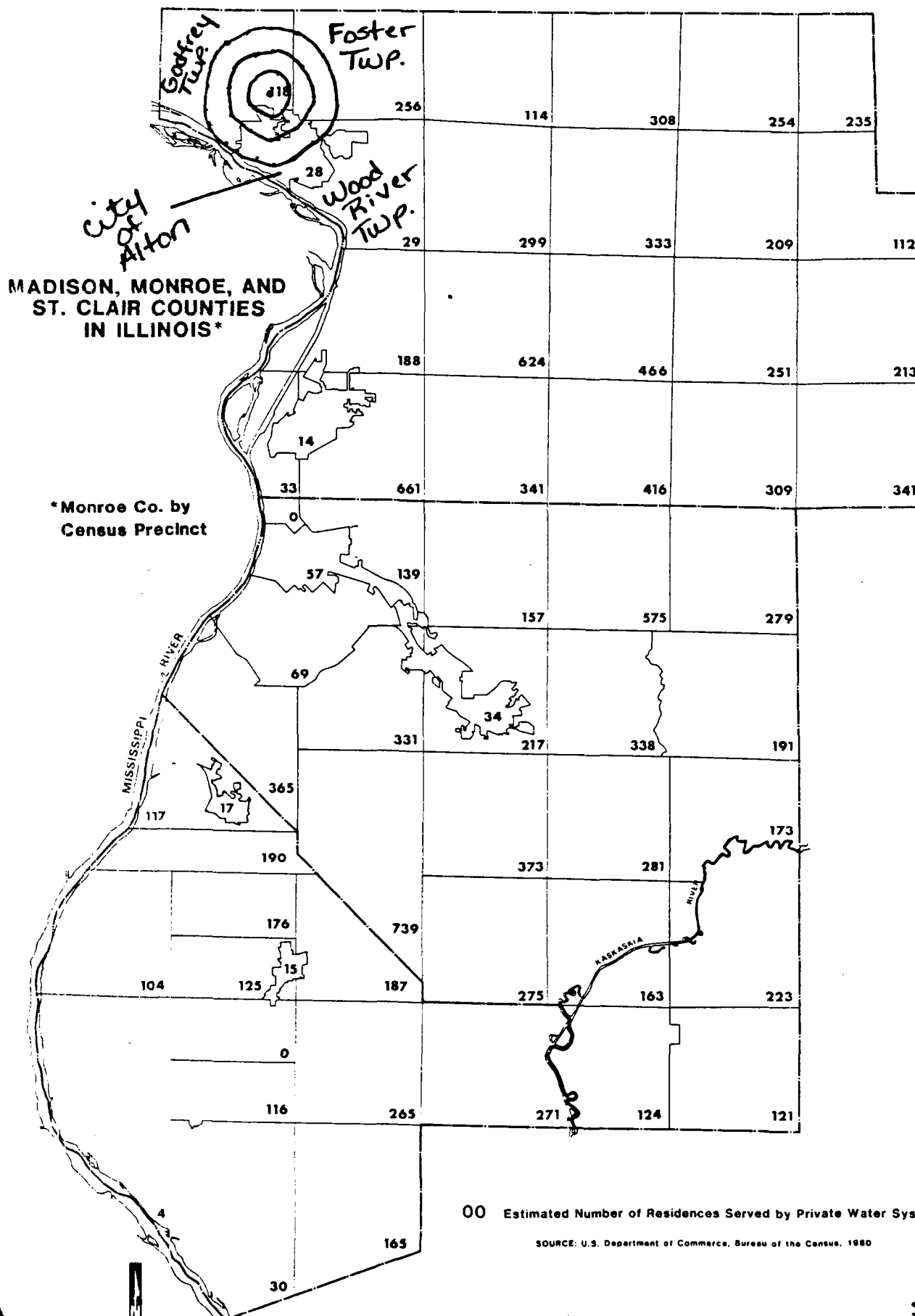
Table 3 summarizes the information for these 9 sites and the results of a comparison of the potential reservoir yields with potential groundwater yields for the same catchment areas. For comparison, the potential groundwater yield was calculated by estimating the potential yield from principal sand and gravel aquifers (Figure 10) in gallons per day per square mile, multiplied by the area of the basin in square miles. For each of the new reservoir sites the potential yield is considerably higher than the potential groundwater yield within each watershed.

1980 Water Withdrawals

Approximately 770 million gallons per day (mgd) was withdrawn for use in Madison, St. Clair, and Monroe Counties. Excluding water drawn from the Mississippi River for electrical power generation the total was considerably lower, about 160 mgd. Groundwater withdrawals accounted for approximately 67 mgd. The locations of public and industrial supply wells and their type of aquifers are identified on Figure 11. ~~With only a few exceptions in the upland, groundwater is pumped from sand and gravel aquifers primarily two aquifers in the Mississippi River flood plain. Since the 1950s a large number of industries and municipalities have turned to the Mississippi River flood plain as a dependable source of high quality water. Within this flood plain, pumpage is generally concentrated in four major pumping centers: Union, Wood River, Granite City, and National City. Fairmont City, Monsanto, Caseyville, Poag, Troy, and Glen Carbon are minor pumpage centers. Groundwater pumpage which was 108 mgd in 1966 dropped to 59.7 mgd in 1980. The reason for this substantial decrease can be attributed to industries abandoning groundwater sources and turning to the Mississippi River.~~

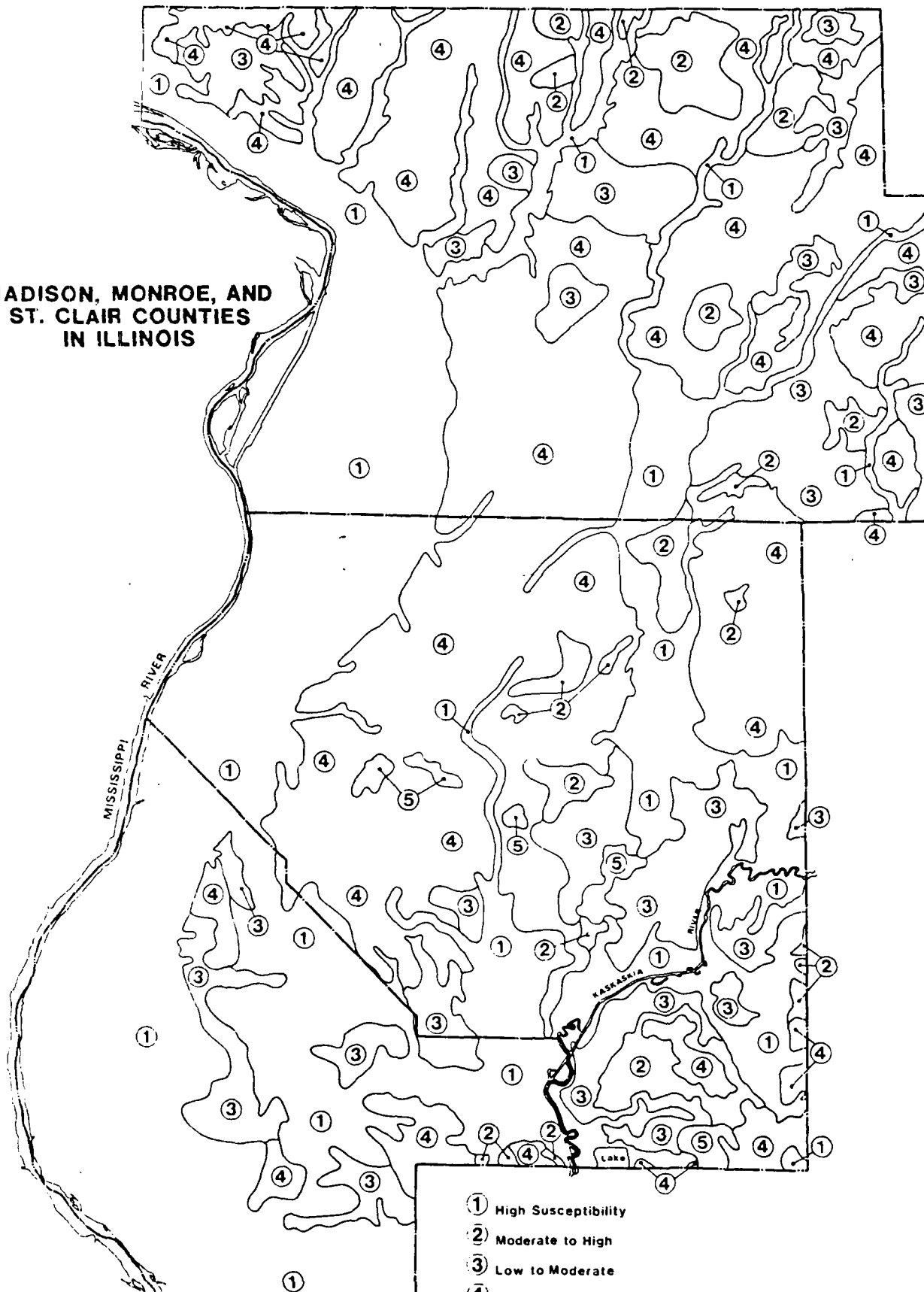
During 1980 groundwater comprised 42 percent of all water withdrawn for use, excluding water that is recirculated for electrical power generation. ~~Of the total amount of groundwater withdrawn, 65 percent was for industrial use, 16 percent was for public water systems, 11 percent for rural domestic supply and 8 percent was used for irrigation and livestock. Twenty municipalities in the three-county area rely on groundwater aquifers as~~

Estimated Number of Residences Served by Private Water Systems



Susceptibility of Shallow Aquifers to Contamination From Land Burial of Wastes

MADISON, MONROE, AND
ST. CLAIR COUNTIES
IN ILLINOIS



- ① High Susceptibility
- ② Moderate to High
- ③ Low to Moderate
- ④ Low
- ⑤ Surface Mine

1 2 3 4 5 6 7 SCALE MILES
1 2 3 4 5 6 7 SCALE KILOMETERS

SOURCE Illinois State Geological Survey

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A GRANT FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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streams in the region. Areas with moderate to high susceptibility have permeable bedrock generally between 5 and 20 feet of the surface and include the large area of Karst in Monroe County and small areas in Madison and St. Clair Counties. Areas with low to moderate susceptibility have shallow sands and gravels within 20 feet of the surface which are overlain and underlain by relatively impermeable till, other fine-grained material or bedrock. These areas are located in eastern Madison and St. Clair Counties. Areas with the least susceptibility to contamination by surface/near-surface waste disposal have a minimum of 20 feet of uniform till or other fine-grained material at the surface or have relatively impermeable bedrock within 20 feet of the surface, mostly overlain by till or other fine-grained material. These areas are found throughout most of the uplands in Madison and St. Clair Counties.

While this classification categorizes materials according to susceptibility to potential contamination, it also rates the materials generally according to potential problems that may limit the operational effectiveness of shallow waste disposal systems and methods. Those materials most highly susceptible to contamination will generally let waste effluent enter easily, and shallow treatment systems, such as a septic system, appear to operate well. The materials least susceptible to contamination, because of low hydraulic conductivities, often do not readily accept waste; acceptance problems may cause septic system failure. The density of septic system units or frequency of application of agricultural chemicals or sewage sludge, topographic considerations and surface soil characteristics may also affect the optimum workability of surface and near-surface waste disposal and their potential to contaminate ground and surface waters. Local soils maps as well as detailed geologic information² are often necessary for proper management of this type of waste disposal.

Land Burial of Municipal Wastes - Shallow Aquifers

Figure 18 shows susceptibility of shallow aquifers to contamination by municipal waste disposal by land burial. Those areas most susceptible to contamination are alluvial or have sand and gravel or permeable bedrock within 20 feet of the land surface, and include the American Bottoms area, the Karst area in Monroe County, the Kaskaskia alluvium, and alluvial valleys of smaller streams in the region.

Areas with moderate to high susceptibility have sand and gravel deposits within 20 feet of the surface, overlain and underlain by relatively impermeable till, other fine-grained material, and/or bedrock. These areas are located in eastern Madison and St. Clair Counties.

²Illinois State Geological Survey. Potential for Contamination of Shallow Aquifers in Illinois.

VIII. CONCLUSIONS AND RECOMMENDATIONS

1. There is no doubt that groundwater aquifers have served to enhance the growth and quality of life in the three-county area. Entire communities and numerous major and minor industries rely on water supply systems which obtain their water from ground sources. ~~Groundwater aquifers are also the major and often sole source for agriculture and private water supply systems.~~ Despite the obvious importance of the groundwater resource, efforts to maintain and protect it have been few and fragmented. Its management has consisted primarily of individual responses to specific problems as they arise. Planning, research and construction activities are undertaken upon the scope of the problem and the jurisdiction of agencies. There is a need for a more unified effort. A regional groundwater management program should be developed which would ensure that the efforts of the many agencies involved in groundwater management are coordinated and directed to the same overall goal and objectives.
2. ~~Groundwater is a valuable resource and its use is increasing.~~ ~~The American Bottoms is the primary groundwater supply aquifer in the three-county area.~~ ~~It is the sand and gravel aquifer in the American Bottoms.~~ Of secondary importance are the sands and gravels found in the Kaskaskia River Bottoms and, to a lesser extent the Silver Creek Bottoms on the basis of their geologic setting. The sand and gravel aquifers in these three areas are also the most susceptible to contamination.

~~The bedrock formations are regionally important as aquifers because of their low yielding capabilities and generally poor quality water.~~ In areas of the upland, however, the bedrock is the only groundwater source. Limited amounts of groundwater for domestic and farm use can be obtained from shallow sandstones and creviced limestones. Karst topography in Monroe and St. Clair Counties makes its bedrock aquifer highly susceptible to contamination.
3. The potential for groundwater pollution is significant in the American Bottoms and relatively less in the remainder of the three counties. The American Bottoms of Madison and St. Clair Counties and its adjacent hillside area have a large density of potential sources of pollution including active and inactive landfills, oil and gas pipelines and storage areas, surface impoundments, salt storage areas, and major transportation corridors. The seriousness of the situation is obvious from statistics cited in this report. There are about 27 permitted operating landfills in the entire three counties of which 18 are located in or adjacent to the American Bottoms. IEPA has identified 27 sites under RCRA which require remedied action, 3 of these are in the East St. Louis area. Industrial activity and the use of road salt are considered the probable major contributors to recent increases in chloride content.